

It should not be taken on an empty stomach, lest it excite nausea.

Dr. Warburton Begbie extols chloride of calcium in ten to twenty grain doses, in scrofula with glandular enlargements of the neck; in cases resembling tabes mesenterica, and chronic diarrhoea with weak digestion. It should be given in milk after food and must be continued for a considerable time, its good effects in many cases not at once becoming apparent.

Lime-water is reputed to be useful in whooping-cough, and this may well be, owing to its astringency; for in certain forms of this disease, astringents, as alum and tannin, often effect a decided improvement.

Lime-water is a useful injection to destroy the thread worms which infest the rectum. It has been also used as an injection in gleet.

From their low diffusion-power, a small quantity only of these substances passes into the blood; so small, probably, that it might well be doubted if they could in any way influence the organs remote from the intestines. But experience shows that lime-water or carbonate of lime are valuable remedies in deficient nutrition, and in convalescence from serious disease, their good effects being most marked in children, in some stages of rickets, mal-nutrition, etc.

In some instances these good results are traceable to the action of the lime salts on the mucous membrane of the intestines. The action of these salts, however, being very similar, although inferior, to that of phosphate of lime, we refer our readers to the section which treats of this salt. One point may be noticed here, confirmed by both theory and experience, that, since but little of these substances pass into the blood, as much good may be obtained from small as from large doses.

PHOSPHATE OF LIME.

BOTH in health and in disease this salt is of very great importance. It must be ranked among the most valuable and necessary foods, being probably as essential to proper growth and nutrition as the nitrogenous and fatty foods. Observations have abundantly proved its physiological importance. It gives solidity to the skeleton, and if the quantity supplied to the body is small, or if the demand for it is greater than the supply, these solid structures suffer and lose their hardness. Chossat produced softening of the bones of animals fed on food free from lime salts; while, during pregnancy, much phosphate of lime being required for the ossification of the skeleton of the foetus, it is found that the fractured bones of pregnant women unite slowly and imperfectly.*

Some experiments by Milne Edwards bear practically on this point. He found that animals' bones intentionally fractured united more quickly if the animals were supplied with phosphate of lime.

But far greater than merely to give solidity to the skeleton, is the importance of this necessary food to the soft and growing tissues, in promoting cell growth and natural nutrition.

That this is a very feasible conclusion the following considerations tend to show:—

1. The presence of this salt throughout the body.
2. Its presence in much larger proportion in the intercellular fluid of the body than in the blood itself.
3. The fact that in herbivora the intercellular fluid is as rich in this salt as it is in carnivora, though the vegetable-feeders take so little of it with their food; hence it must be carefully retained in the intercellular fluid for some important purpose.

In respect to the two foregoing considerations, it must be

* The urine of pregnant women is said to be deficient in lime salts, but the evidence on this point is very discrepant.

borne in mind that phosphate of lime is soluble in acids, and as the intercellular fluid is acid, the phosphate would be expected to accumulate in it.

4. Schmidt's observations show "that a certain quantity of phosphate is required to supply the first basis for the new tissues, even in the case of those organs which subsequently exhibit an excess of carbonate of lime," as the shells of animals; an observation showing that phosphate of lime is necessary to initiate growth, and, in this respect, is not interchangeable with the carbonate.

5. Wherever cell-growth is active, there is phosphate of lime in excess,—a statement holding good both with regard to healthy and diseased growths; for even in disease, associated with rapid formation, this salt is found to prevail.

Viewing the subject theoretically, it might be supposed that abundant knowledge exists to enable us to determine the occasions when to employ this salt remedially. In defective nutrition, or deficient cell growth, it would be assumed that the phosphate of lime would prove serviceable, and experience fully corroborates this inference. Certain theoretical objections have been urged against the employment of this salt. It has been said that the fault is really not due to deficiency of lime, but inheres in the tissues, which fail to assimilate it. It is urged that, in cases of defective cell-growth and of malnutrition, the quantity of the phosphate in the urine is unusually great; and, consequently, in such cases our efforts should be directed to remove the circumstances which check assimilation. It is as little reasonable, it may be said, to treat diabetes with sugar, as a diabetes of phosphate of lime, with phosphate of lime. Some truth there is, no doubt, in these strictures, and too much attention cannot be paid to ensure the hygienic conditions favourable to assimilation, as good air, abundant light, and sufficient exercise. The case before us is more analogous to anæmia than to diabetes; and we give iron with decided benefit in anæmia even where this condition is due, not to want of iron in the food, but to the non-assimilation of it by the tissues. The efficacy of phos-

phates, however, must be decided by experience, and this speaks abundantly in its favour. Beneké, to whom on this subject we owe much of our knowledge, both physiological and therapeutical, has shown that phosphate of lime is especially useful in those very diseases wherein it occurs in excess in the urine, as hectic, and chronic wasting disease.

This salt is of great use in the anæmia of young and rapidly growing persons, and women weakened by rapid child-bearing, prolonged suckling, or excessive menstruation. In checking chronic tubercular and non-tubercular diarrhœa, and other profuse discharges, as in leucorrhœa, chronic bronchitis, and large abscesses, it is a valuable remedy, effecting in these states both general and local improvement. Beneké greatly praises its influence on scrofulous sores. It is useful also in caries of the bones.

Women dwelling in towns are apt to have a deficiency of this salt, and are improved by its administration; an increased quantity too, finds its way into the lime-lacking milk of a suckling mother, and thus both she and her child are simultaneously benefited.

Persons in broken health from prolonged town life or overwork, or who from other causes are languid, hipped, and incapable of much exertion, are often much benefited by this medicine. In cases like this, a good formula is a grain of phosphate of lime, phosphate of iron, and carbonate of lime; but phosphate of lime will act admirably by itself. In the chronic forms of phthisis, with little or no fever, this medicine is useful. It should be taken on the tongue, either dry or mixed with a little milk.

The author thinks no reasonable doubt can be entertained of the efficacy of phosphate of lime in many cases of rickets.

It has been sought to establish a connection in all cases between a deficient supply of lime and rickets, and in favour of this view it is urged that rickets commonly occur during the first dentition, when much lime is required by the growing teeth, and that rickets affect the children of mothers in that state of ill health in which it has been established that

lime is deficient in their milk. There may be much truth in these statements; but, as in many cases of rickets an excess of lime is found in the urine, the disease in such cases cannot be held to depend on a deficient supply of the salt, but must be due to other circumstances, with which, at present, we are only partially cognizant. In cases where the disease is dependent on deficiency of phosphate of lime, its administration is obviously all that is required.

In rickets, moreover, there is not merely deficient ossification of the bones, but unnatural growth and defective nutrition, both in the skeleton and in the other textures of the body. The phosphate of lime appears to control this defective and perverse nutrition, and to induce healthy growth, so as not merely to favour the consolidation of the skeleton, but to improve the condition of the soft organs, and experience shows abundantly that many rickety cases are benefited more decidedly by lime salts than by any other single drug.

German authorities who have studied this subject most attentively, consider that the fittest time to give this remedy is only after the cessation of the active stages of the disease, that is, when the pains and tenderness of the bones have disappeared.

It is well here to caution against the uselessness of administering this or other lime salts in large quantities, as, from their very low diffusion-power, very little passes into the blood. A grain or two grains, several times a day, is a sufficient dose. Given in excess, it hinders digestion.

Phosphate of lime in the stomach must be variously affected by the free acids, as lactic, hydrochloric, and, in a lesser degree, acetic acid, dissolve it.

Most of the phosphate of lime taken into the stomach passes into the intestines, where, if its use is too long continued, it is liable to form concretions. Being unaffected by the pancreatic and biliary secretions, and but slightly soluble in the intestinal juice, most of the phosphate passes off with the stools.

Phosphate of lime is highly recommended in various forms

of chronic diarrhoea, and especially in that of young children, to whom it may be given with carbonate of lime and lactate of iron. Whether the beneficial effects are due to its direct action on the mucous membrane, or take place after absorption, in the manner previously described, our present knowledge does not enable us to decide.

Being soluble in the acids of the gastric juice, and to some extent in solutions of common salt, its passage into the blood takes place probably in several ways. It has, however, been doubted whether any portion, if uncombined with food, passes into the blood, since no augmentation of this salt is met with in the urine; nay, in some cases it seems even lessened. The observations on this point are, perhaps, too scant to set the question at rest.

Much phosphate is taken either in combination with the food, or so intimately blended with it that it is well-nigh impossible to separate it from the tissue-forming substances, and so it finds ready entrance into the blood, with the digested materials constituting the chief, and in ordinary cases the only, source of phosphate of lime for the supply of the system. That so alkaline a fluid as the blood is capable of dissolving the phosphate, is explained by its solubility in solutions containing free carbonate acid or common salt.

HYPOPHOSPHITE OF LIME.

SODA.

These medicines have been extolled for their efficacy in some forms of phthisis, and have found more favour with American than with English practitioners. In America they are used in other diseases besides phthisis, as "nervous and general debility." (See Phosphate of Lime.) In ordinary doses the soda salt often purges slightly, even ten grains thrice daily may produce this effect.

CHLORIDE OF POTASSIUM.
 " **SODIUM.**
 " **AMMONIUM.**

These substances, having many chemical and therapeutic qualities in common, have been grouped together; but the remarks in this section refer mainly to chloride of ammonium.

These salts are freely soluble, and possess high diffusion-power. They have a saltish taste, which, in the case of chloride of ammonium, is very disagreeable, and constitutes one of the objections to its use.

All these chlorides increase considerably the secretion from the mucous membrane; and may indeed even excite catarrh. This is notably the case with chloride of ammonium, which is consequently employed chiefly when it is desired to influence the mucous membrane. How do they promote the formation of mucus? Let us take the instance of common salt. Chloride of sodium is a large constituent of mucus, and when taken into the system, salt probably promotes the production of those secretions of which it forms a large part. It is, indeed, a food to the mucous membranes. This suggestive hypothesis may possibly apply in the case of other members of this group. These substances, and especially sal ammoniac, are not uncommonly employed in catarrhal conditions of the intestines, and to prevent the formation of that thick tenacious mucus which forms an excellent nidus for various worms infesting this canal.

Owing to their high diffusion-power, these salts pass rapidly into the blood, and travel too small a distance along the intestines to act as purgatives; so that, unless administered in considerable quantity, they exert very little influence on the character of the motions.

Common salt is used to produce sickness, or to promote it after taking other emetics. Given in poisoning by nitrate of silver, it effects a double decomposition, precipitating the silver as the harmless insoluble chloride.

Chloride of ammonium is often given with considerable success in chronic catarrhs of the bronchial and urinary mucous membrane. It is indicated in chronic bronchitis when the secretion is thick and abundant, and it may be applied topically to the morbid mucous membrane by the atomizer.

The same remedy has been lauded for whooping-cough. It is said to be frequently successful in removing the pain of facial neuralgia "of rheumatic character." It should be given in half-drachm doses, and if, says Sir T. Watson, four doses fail to give relief, the drug may be considered unsuitable for the case. The author has many times found it useful in facial neuralgia; and Dr. Anstie speaks well of it in migraine, clavus, myalgia, intercostal and hepatic neuralgia and in mild forms of sciatica. It must be given in full doses several times a day.

Many practitioners highly esteem the salt in all forms of neuralgia, and I have heard some eminently practical men go so far as to assert that in this painful affection they require no new remedy, since chloride of ammonium so rarely fails. Dr. Thompson also lauds this remedy, holding it only second to phosphorus.

Chloride of ammonium is given with advantage in headaches due to menorrhagia, amenorrhœa, etc.

Common salt sometimes arrests hæmoptysis. Half a teaspoonful should be taken undissolved, and be repeated occasionally till nausea is produced.

Dr. Parkes states that "muriate of ammonia is not oxidised, but passes out unchanged by the urine." "According to Böcker, it increases (in health) all the constituents of the urine, except the uric acid, which it slightly diminishes. The mean daily increase of the urea in these experiments was 4.793 grammes, or 74 grains, an amount which indicates a vast augmentation of metamorphosis or of elimination. The volatile salts and extractives were increased by no less than 18.959 grammes, or 292 grains, which was, no doubt, partly owing to the presence of the volatile chloride of ammonium." (Parkes on Urine).